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Advanced Power & Energy

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Johnstown, PA

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CTC Advanced Energy

- Capabilities Overview
 - Advanced Energy Test Center
 - Fuel Cell Demonstrations
 - Ground Support Equipment
 - In-house alternative fuels expertise
 - Meeting Energy Policy Goals
- Independent, Unbiased Third-party
- Technology Scouting and Roadmapping
- Program Development and Management
- Demonstration and Validation
- Transition and Implementation
- Team Building (government, industry, DOD)- We “connect the dots”

Focused on improving energy surety



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Advanced Energy Test Center

- Established in 1998
 - ERDC-CERL, UTCFC & CTC
- Located in Johnstown, PA (CTC's ETF Facility)
- >35,000 sq. ft. (test equipment, test stations, integration infrastructure)
- Technology and Vendor Neutral
- Recognized as a National Resource for 3rd Party RDT&E
- Original FCTec Mission: to advance fuel cell systems from 3 KW to 300 KW
- Wide Variety of Engineering Expertise for Design, Engineering, Integration, Demonstration, and Implementation
- System Integrators
- One Stop Shop / Turn-key Programs
- Utilized by Government, Developers, and End Users

The Test Center Provides Unique Services & Capabilities

CTC Contributes to Fuel Cell Field Demonstrations

- Fuel Cell Demonstrations

- Clients

- ERDC-CERL , FAA, NFS, CVNP, various Army installations

- Objective

- Demonstrate residential sized fuel cell power plants utilizing different fuels (Hydrogen, natural gas, propane)

- Accomplishments

1. Procured fuel cell power plants from IdaTech, Acumentrics, ReliOn, and SW/FCT (SOFC & PEMFC)
2. Completed site design for FAA, NFS & CVNP demos
3. Installed fuel cell power plants at 4 FAA sites, NFS & CVNP

- Completed



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Scalable Microgrid Design Validation

- Microgrid Overview – Design, installation, and test of microgrid with distributed generation sources and loads.
 - Modeling and Simulation – Software tool to confirm design strategies and solutions
 - System Controllers – Combination Distribution Management System and Internet resource
 - Renewable Energy Sources – Combined generation of conventional generation with renewable energy sources

CTC Validates Fuel Cell Power Plants for Tent City and Aircraft GSE Applications

- Common Core Power Production (C2P2)

- Clients

Phase I - AEF Battlelab

- Objectives

One common engine for deployable assets

- Accomplishments

Business Case Analysis - ECAMSM

- Diesel, turbine, FC, etc.
- PEM fuel cell selected

Demonstrations

- Office equipment (4.0 kW-120VAC-60Hz)
- Aircraft power (8.0 kW-208/120VAC-400Hz)
- Industrial/aircraft equipment (12.0 kW-480/277VAC-60Hz)

Application

- 1st Fuel cell powered aircraft tow vehicle (12 kW PEM FCS)



CTC Validates Fuel Cell Power Plants for Tent City and Aircraft GSE Applications

- C2P2

- Clients
Phase II – APTO / ERDC-CERL
- Accomplishments

- MB-4 Tow Vehicle Integration
 - Electric drive conversion
 - 65 kW PEM FC
- 5 kW Hydrogen On-Demand
 - Design and construct
 - Test and evaluate
- 5 kW PEM Test and Evaluation
 - Reliability and transient reliability
 - Parallel operations
- JP-8 Plasma Arc Reformer Testing
 - Emissions testing
 - Energy balance



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HCATT Electric Vehicle

- Clients
Hawaii Center for Advanced Transportation Technologies
- Objective
Design, assemble, and test a fuel cell augmented electric utility vehicle to support flightline maintenance requirements



HCATT Electric Vehicle

- Accomplishments

Custom utility bed manufactured to house the fuel cell, balance of plant and maintenance support systems

Hydrogenics 12 kilowatt (kW) fuel cell system

On-board 120/240VAC power

On-board air compressor with retractable hose

Air operated mast with halogen work lights



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Fuel Cell Augmented MHE

- 20 - CROWN FC 4520/25-40 (GFE)
- Load Capacity – 4000 lbs
- Power – Electric
- Lifting Height – 188 in
- Battery voltage 36/48 v
- Natural Gas to Hydrogen Infrastructure

BENEFITS

- Increased productivity
- No battery stations
- Eliminates 2 to 3 battery packs per forklift



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Alternative Fuels

- Independent expert fuels assessments
 - Chemical characterization of fuel components
 - Qualification testing of fuels per specifications
 - Fuel blending strategies
 - Synthetic and biomass blended with petroleum based fuels
 - Modeling and simulation
 - Process/Product modification and optimization
 - Aspen Plus for steady-state simulation, design, performance monitoring, optimization and business planning
 - Plant simulation for design and operational improvement
- Internal Research and Development: Biofeedstock oils to “biocrude”
 - Modeling, characterization and product production

Alternative Fuels Evaluations

- Fisher-Tropsch (natural gas and coal gasification techniques)
- Bio-based
- Additives (O₂ Diesel)
- Plastics to fuels
- Ethanol
- Blends



Meeting Energy Policy Goals

- Energy needs assessments and solutions
- Analysis and deployment of renewable energy resources
- Energy security assessments and vulnerability resolution

Questions??



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BACKUP SLIDES



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Long Term Vision - Future

- Advanced Energy Center of Excellence – providing Energy Security and Sustainability through Advanced Energy Solutions
- Turn-key Programs to transition Alternative P&E Technologies for practical use in military applications through various TRLs
- Centralized, Independent RDTE, Integration, Optimization Service of Alternative Energy Technologies for Government Agencies and Private Industry



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Advanced Energy's Test Center Equipment Provides Versatile Test Environments

- Altitude Chamber
- Environmental Chamber
- EMC Chamber
- Emissions Monitoring Trailer
- Shock & Vibration Table
- AC/DC Load Simulators
- Logistic Fuels Supply
- Resistive/Inductive Load Banks
- Thermal Load Banks
- Home Simulator
- Grid Simulator
- Gas & Fluid Analysis Systems
- SOFC Stack Tester
- Reformer Test Station



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Test Center Designed to Support Multiple Test Programs



Transportation Test Station



Home Simulator



Stationary Test Station



Multiple Fuels Distribution System



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Military and Industry Leaders Are Some KEY Clients for the Test Center

- ERDC-CERL
- AEFB
- Robins AFB
- AFRL
- FAA
- National Forest Service
- HCATT
- IdaTech
- Ballard
- Acumentrics
- Millennium Cell
- RDECOM
- DOE / NETL
- Plug Power
- UTCFC
- Fuel Cell Energy
- Hydrogenics
- Intelligent Energy
- Siemens Power
- ReliOn
- Protonex